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Grengs

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(54) **TIRE MANIPULATION SYSTEM**

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B60B 30/02 (2006.01)

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CPC ***B60B 29/001*** (2013.01); ***B60B 29/002*** (2013.01); ***B60B 30/02*** (2013.01); *Y10S 414/124* (2013.01)

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CPC B60B 29/002; B62B 2202/031; B66C 1/485; B66F 9/183; B66F 9/184; Y10S 414/124; E02F 3/3645; E02F 3/3681; E02F 3/3686
USPC 414/11, 23, 24.5, 426, 429, 620, 621, 414/684, 732, 741
See application file for complete search history.

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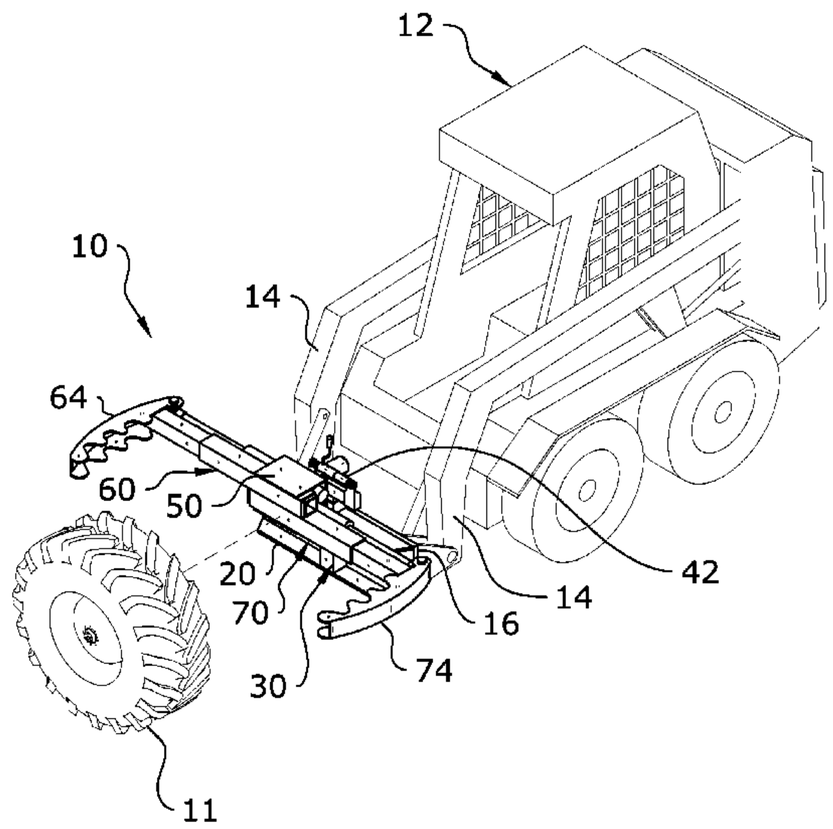
(57) **ABSTRACT**

A tire manipulation system for efficiently manipulating the position of a tire. The tire manipulation system generally includes a mounting device for removable attachment to a tractor, a telescoping main support structure attached to the mounting device, a main actuator connected to the main support structure, a pivot axle rotatably connected to the main support structure, a support frame connected to the pivot axle, and a pair of telescoping supports each having an actuator and a gripping member for engaging a tire to be manipulated. The gripping members first engage the perimeter of a tire to be manipulated and then using the loader system of the tractor the user is able to manipulate the attitude of the tire.

18 Claims, 14 Drawing Sheets



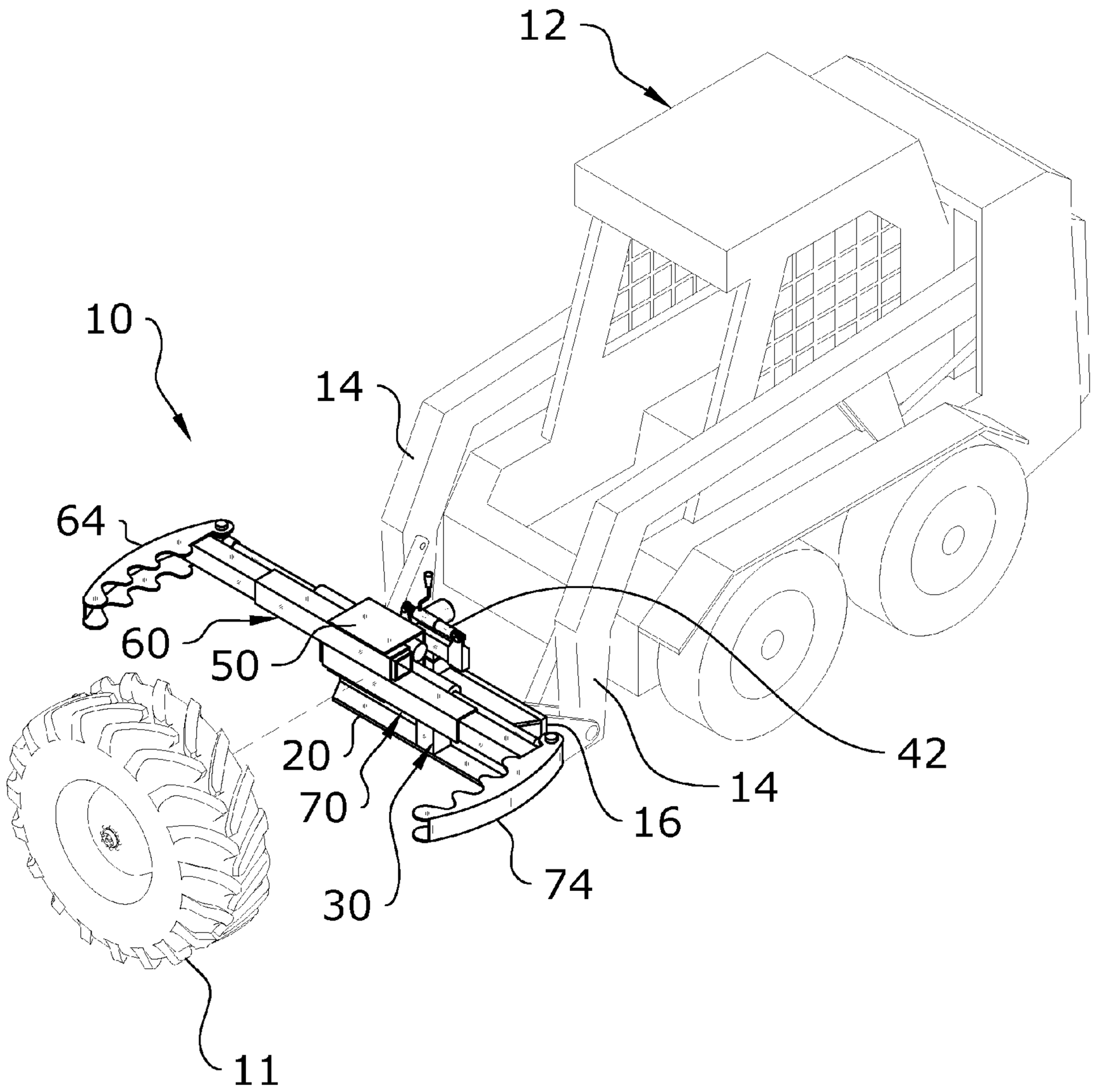


FIG. 1a

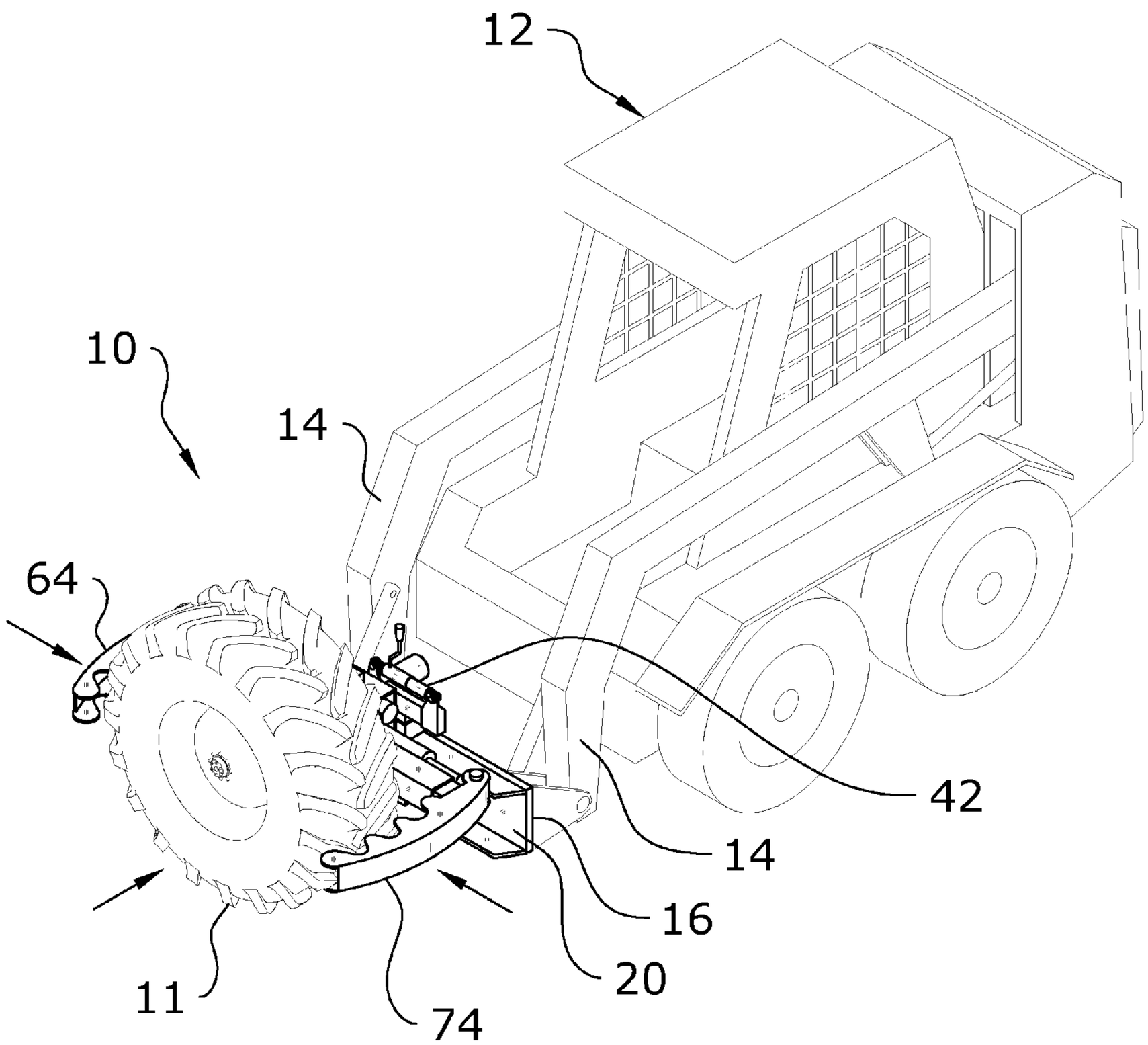


FIG. 1b

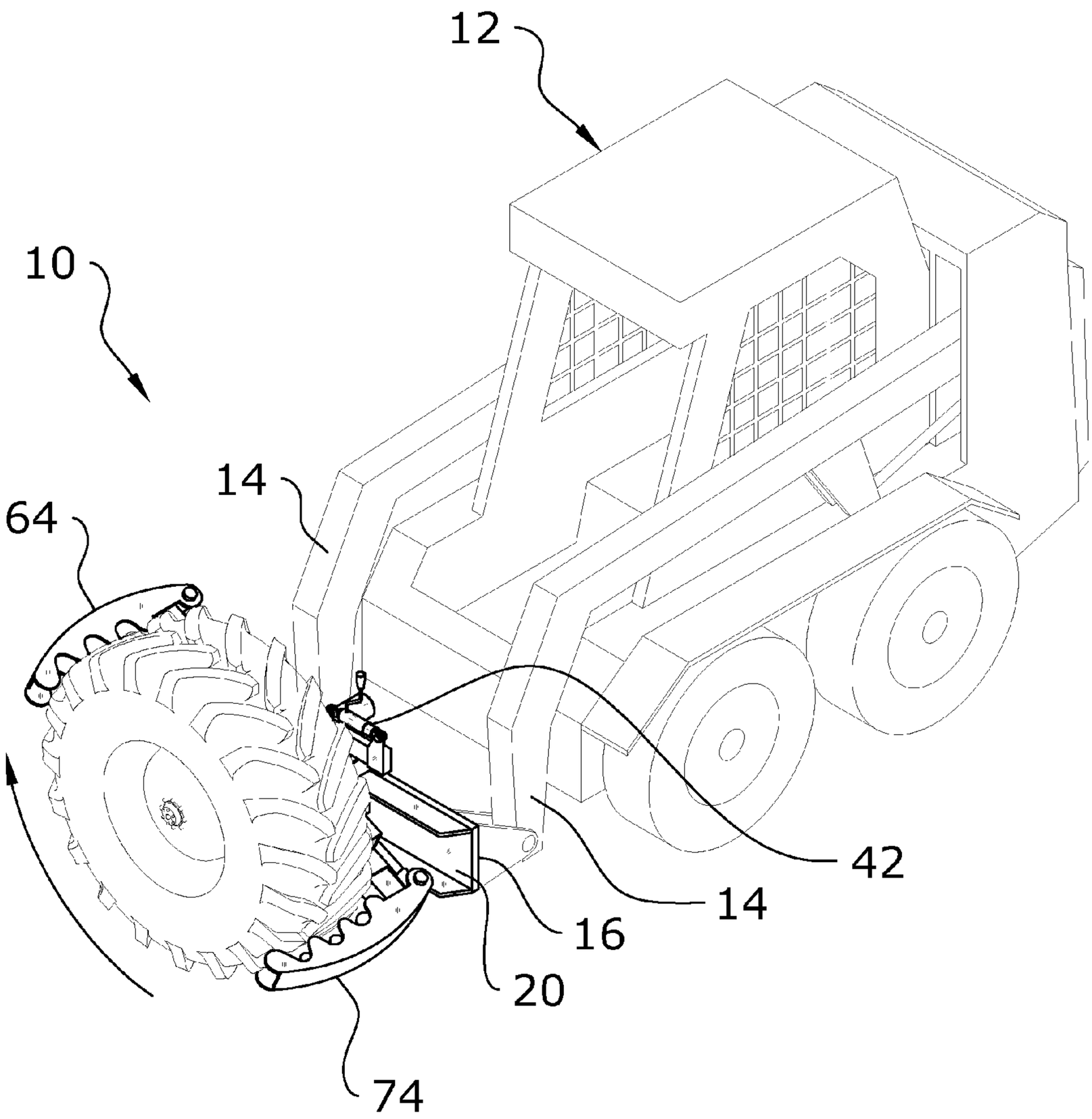


FIG. 1c

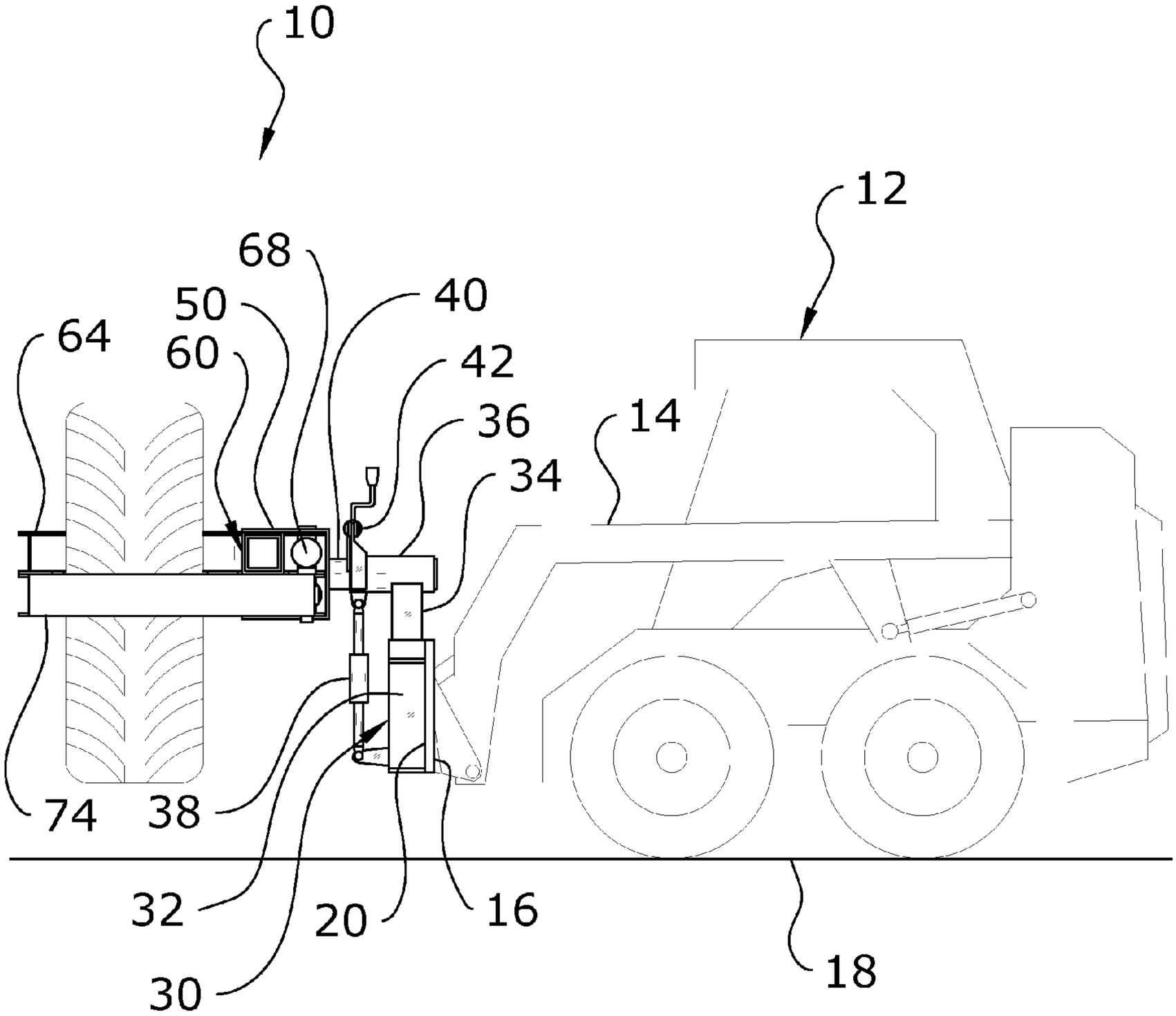


FIG. 1d

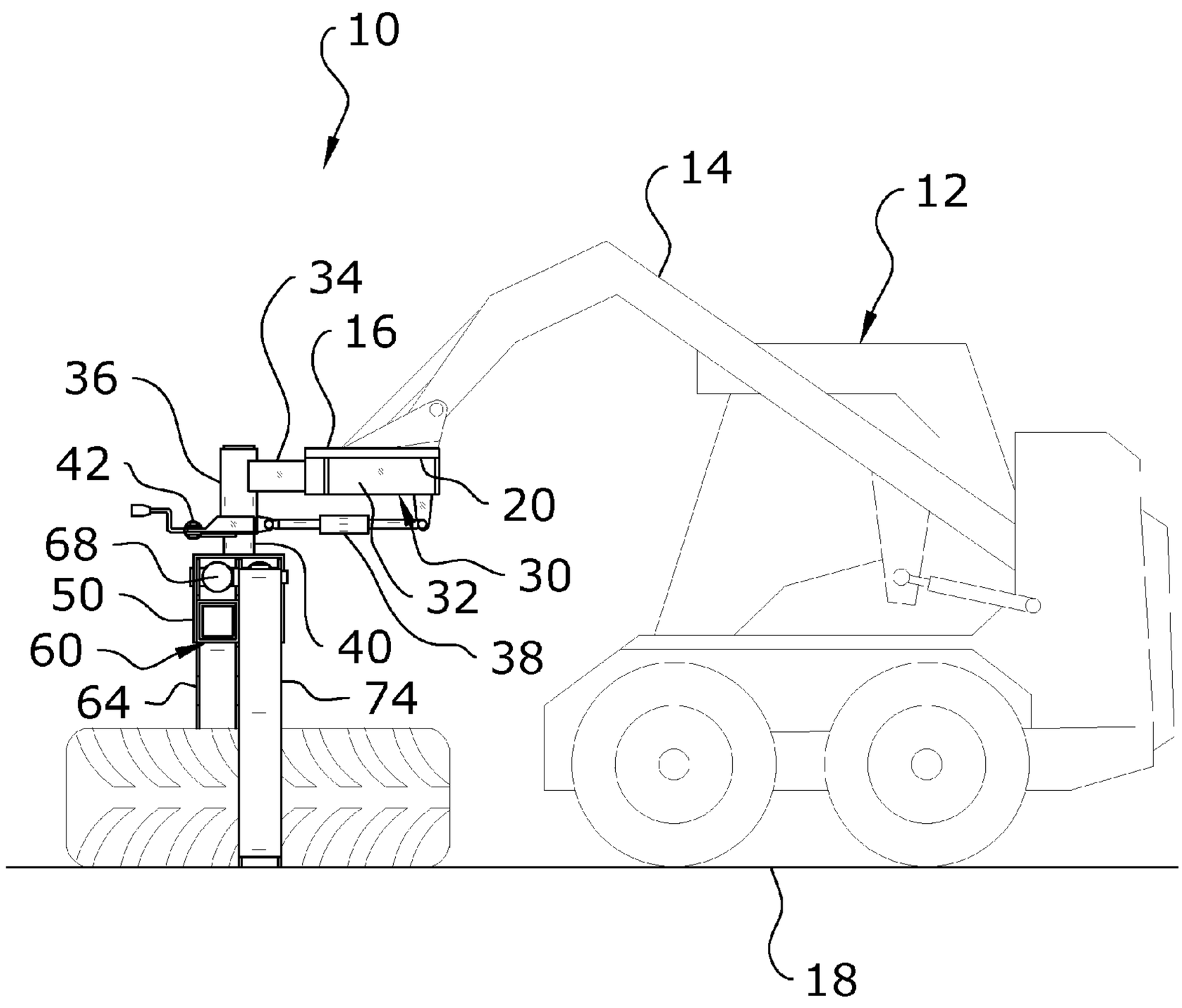


FIG. 1e

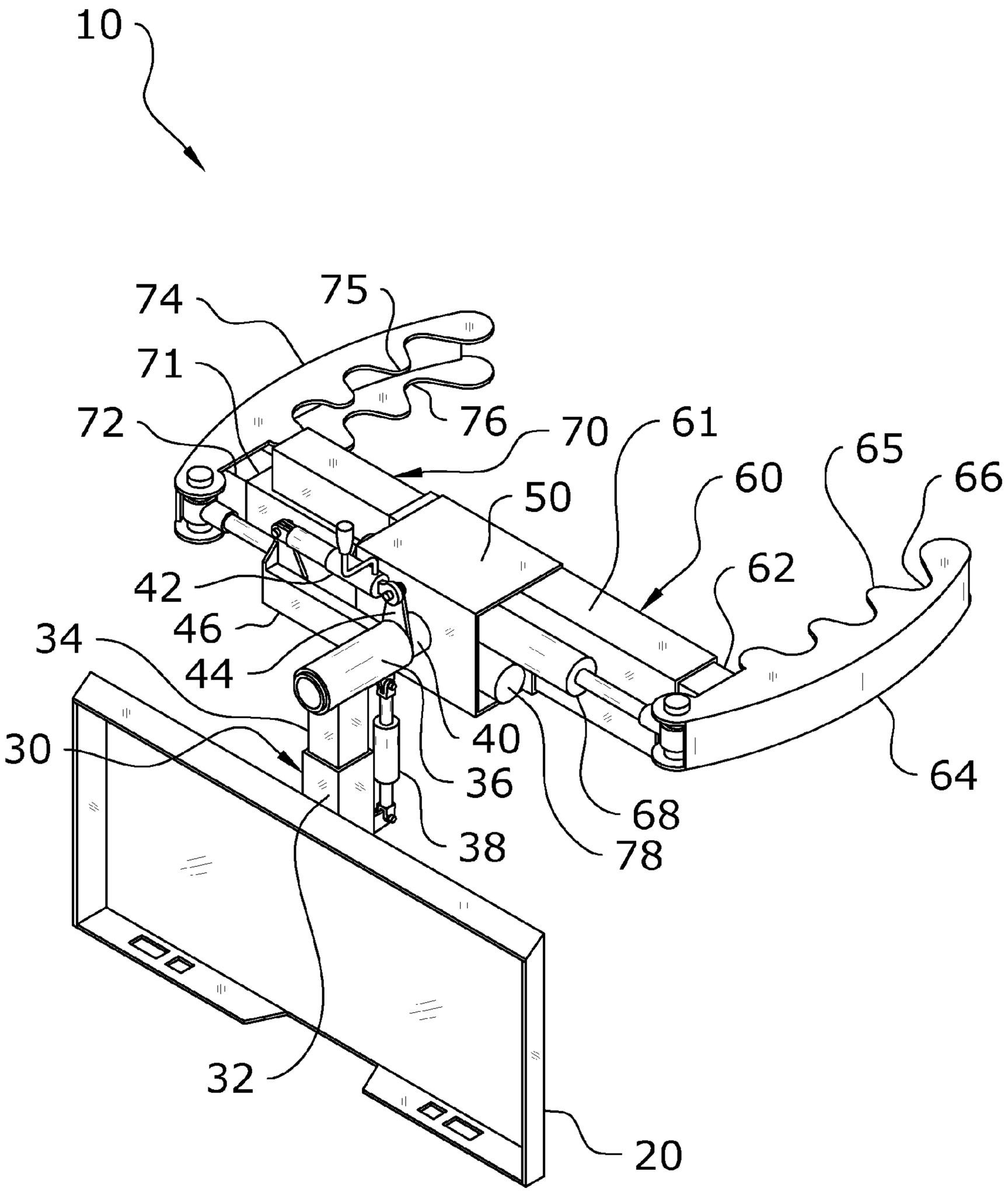

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FIG. 2

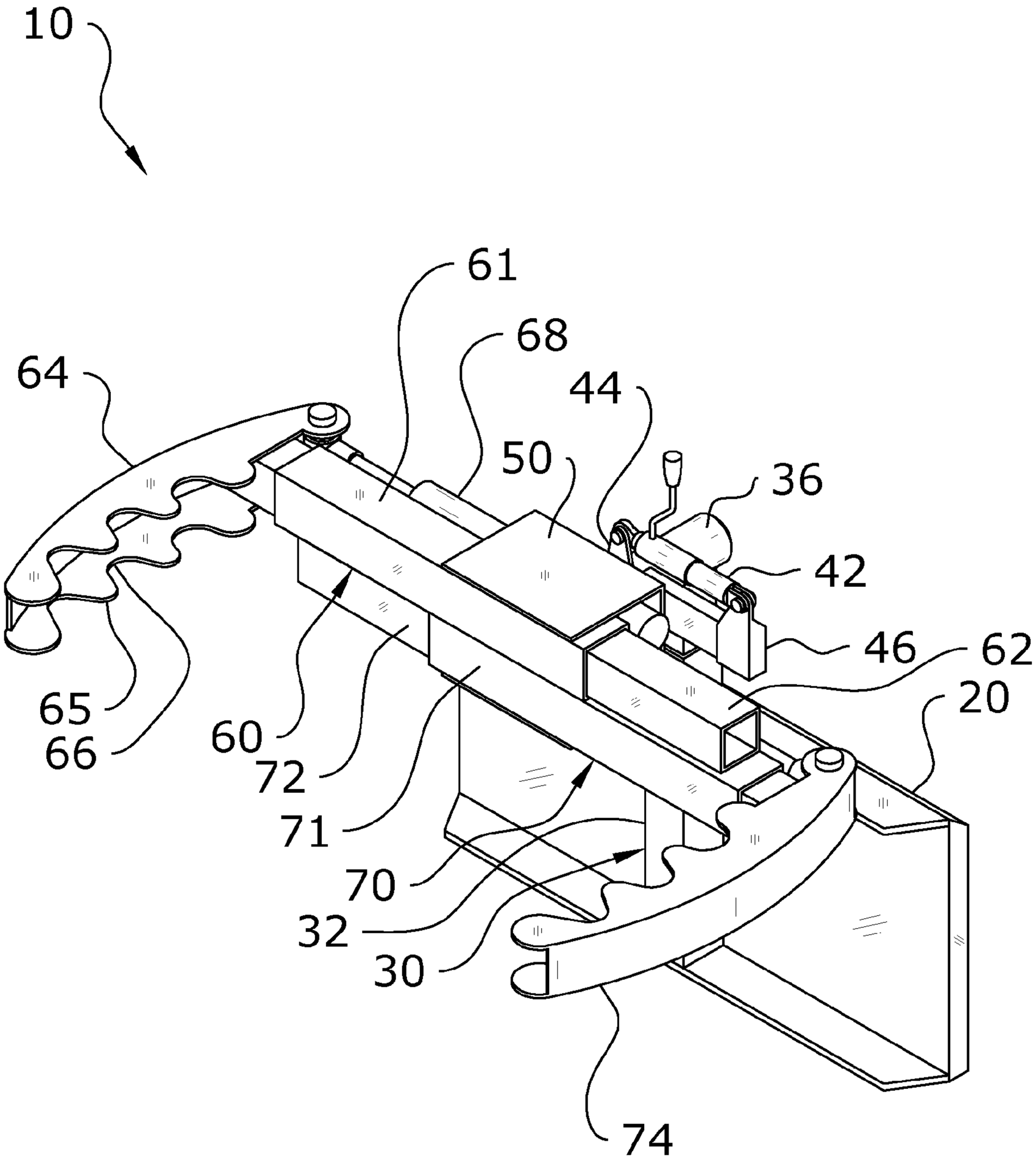

FIG. 3

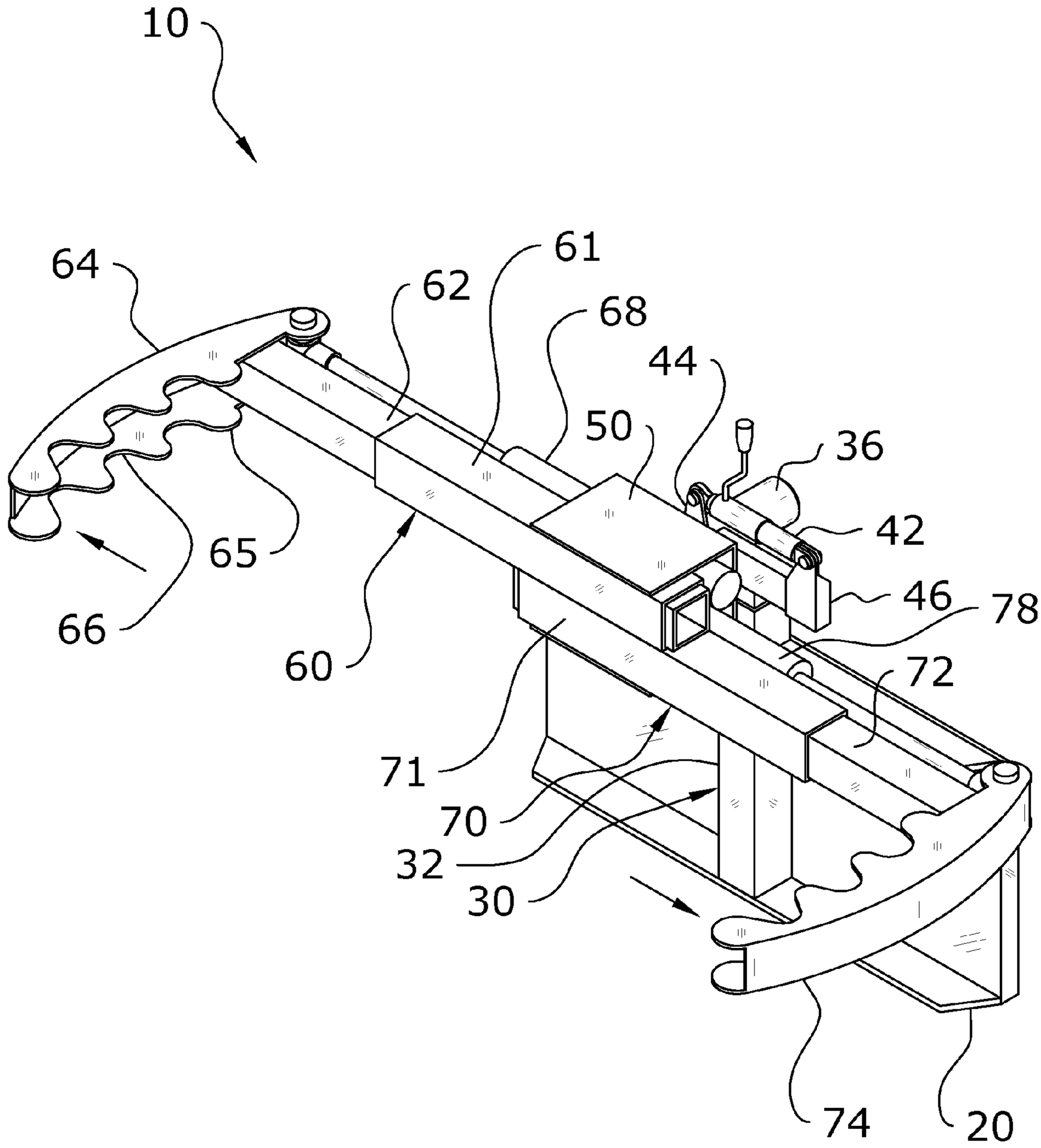

FIG. 4

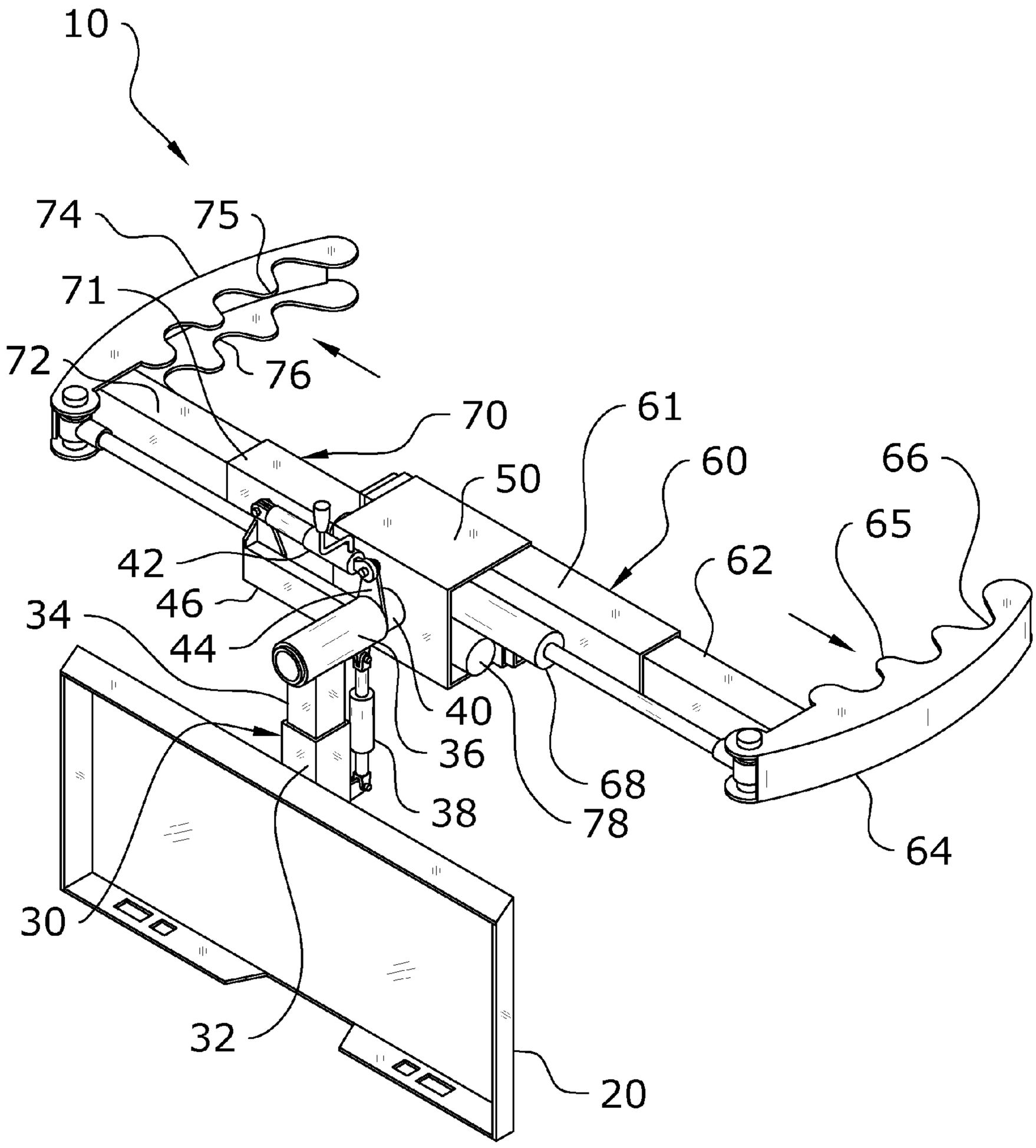
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FIG. 5

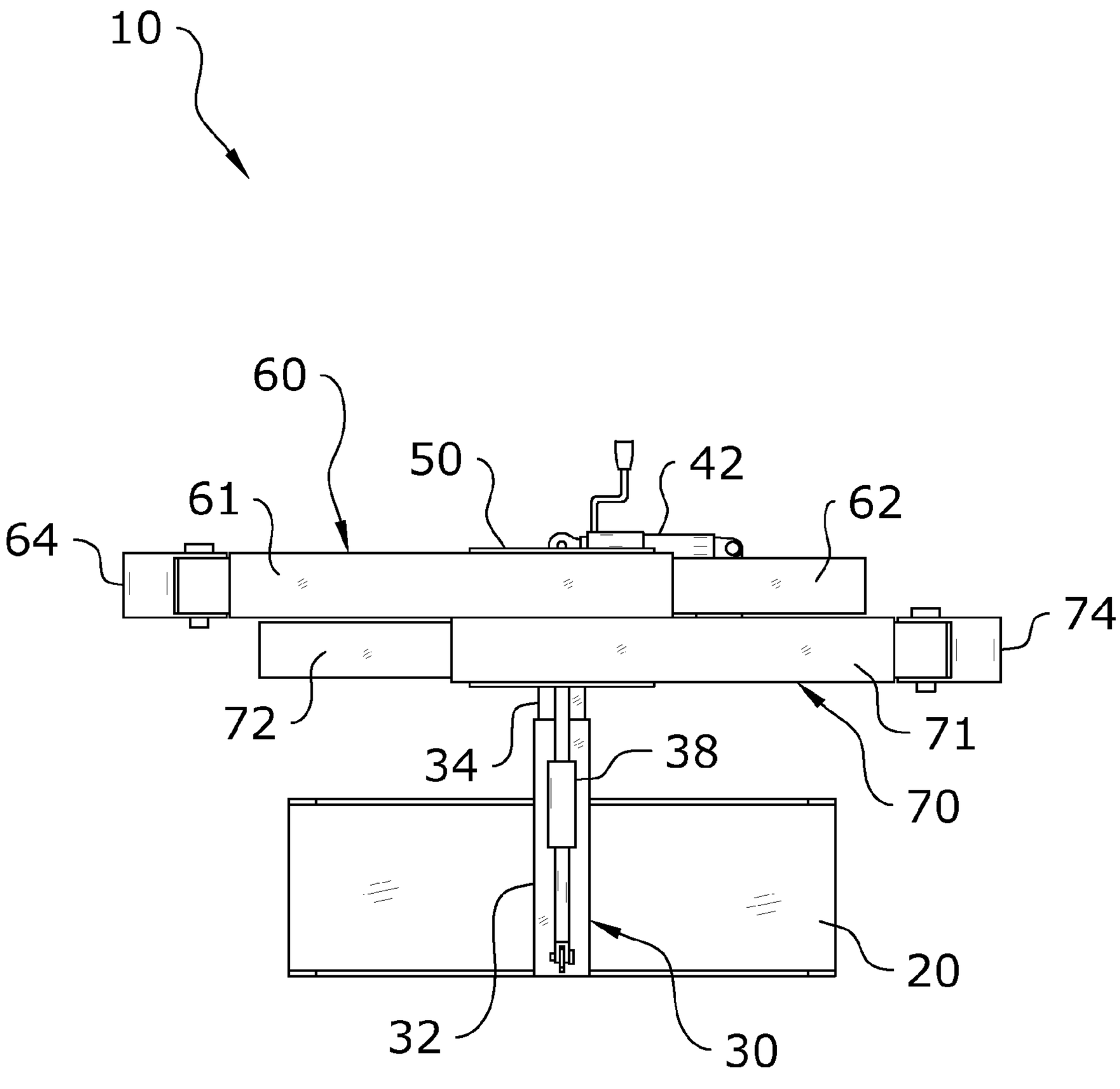

FIG. 6

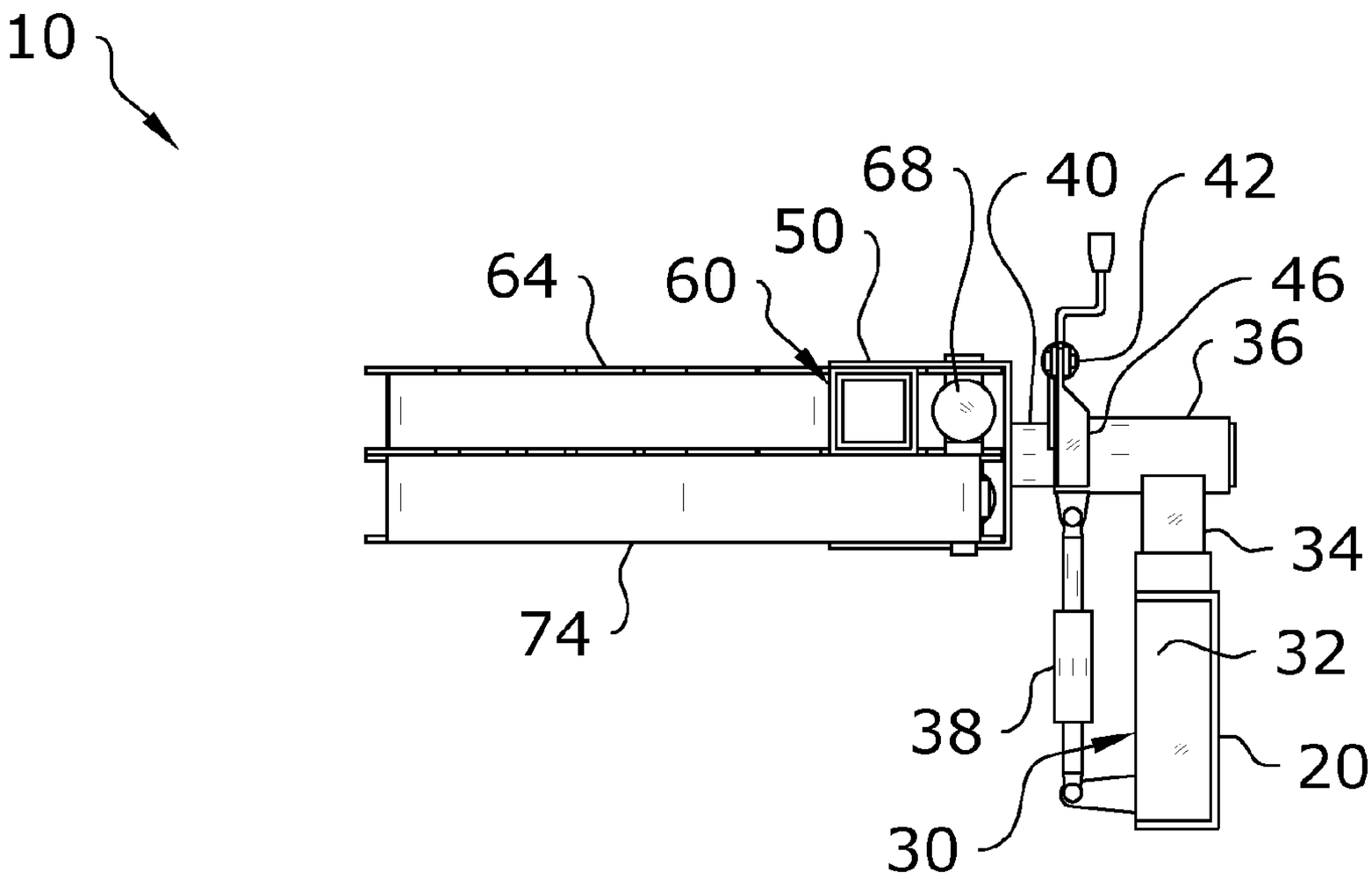
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FIG. 7

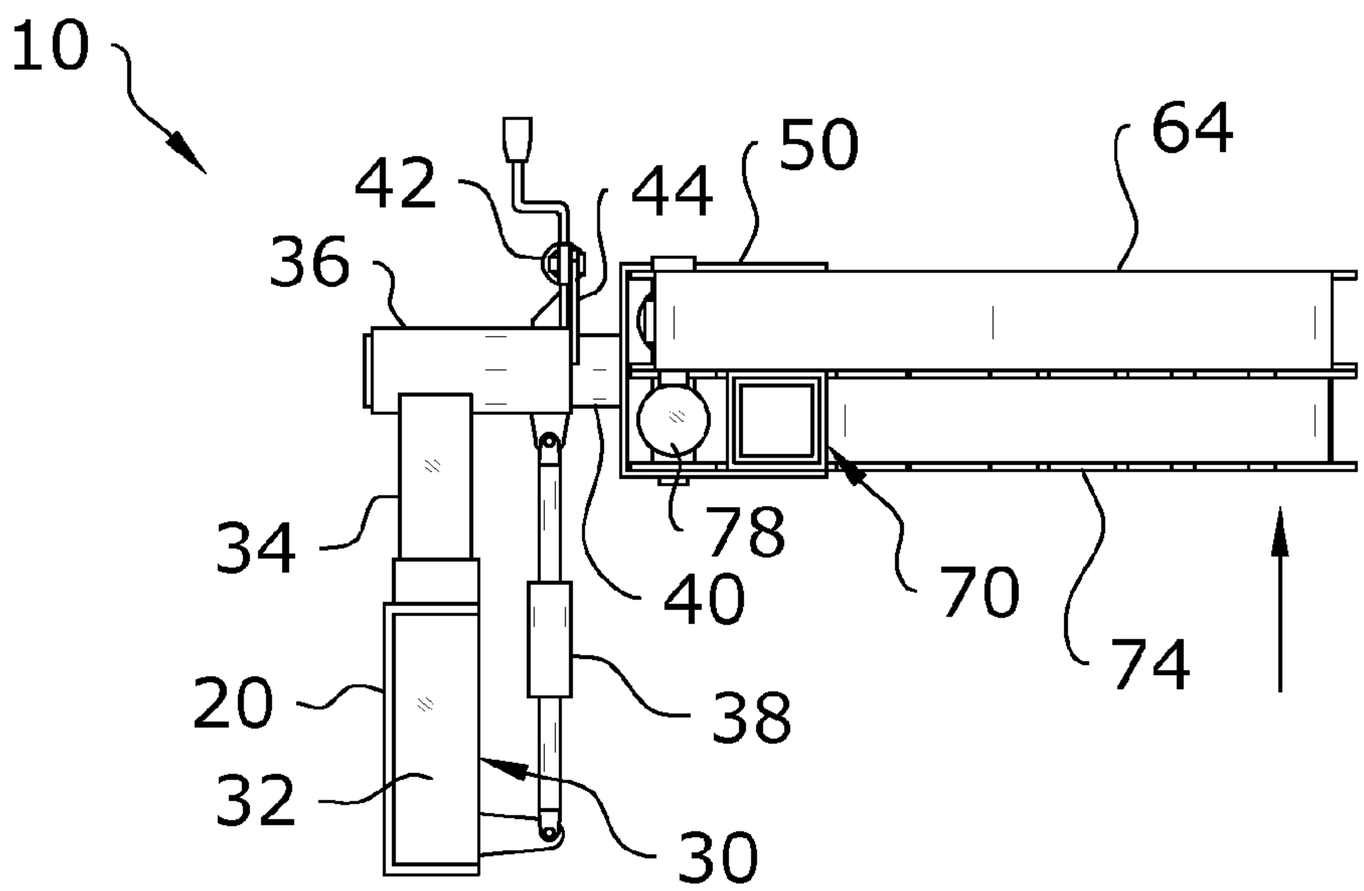
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FIG. 8

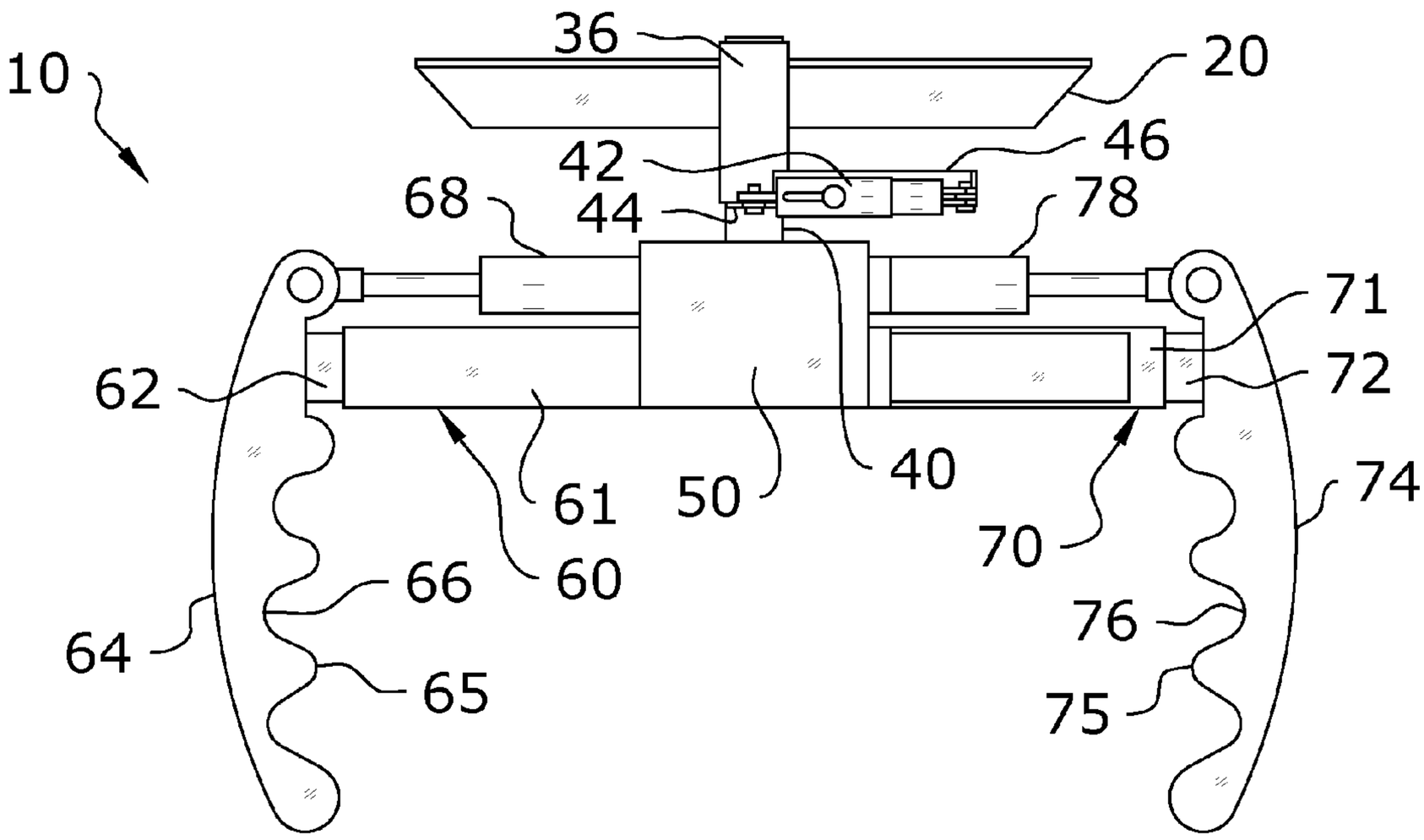
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FIG. 9

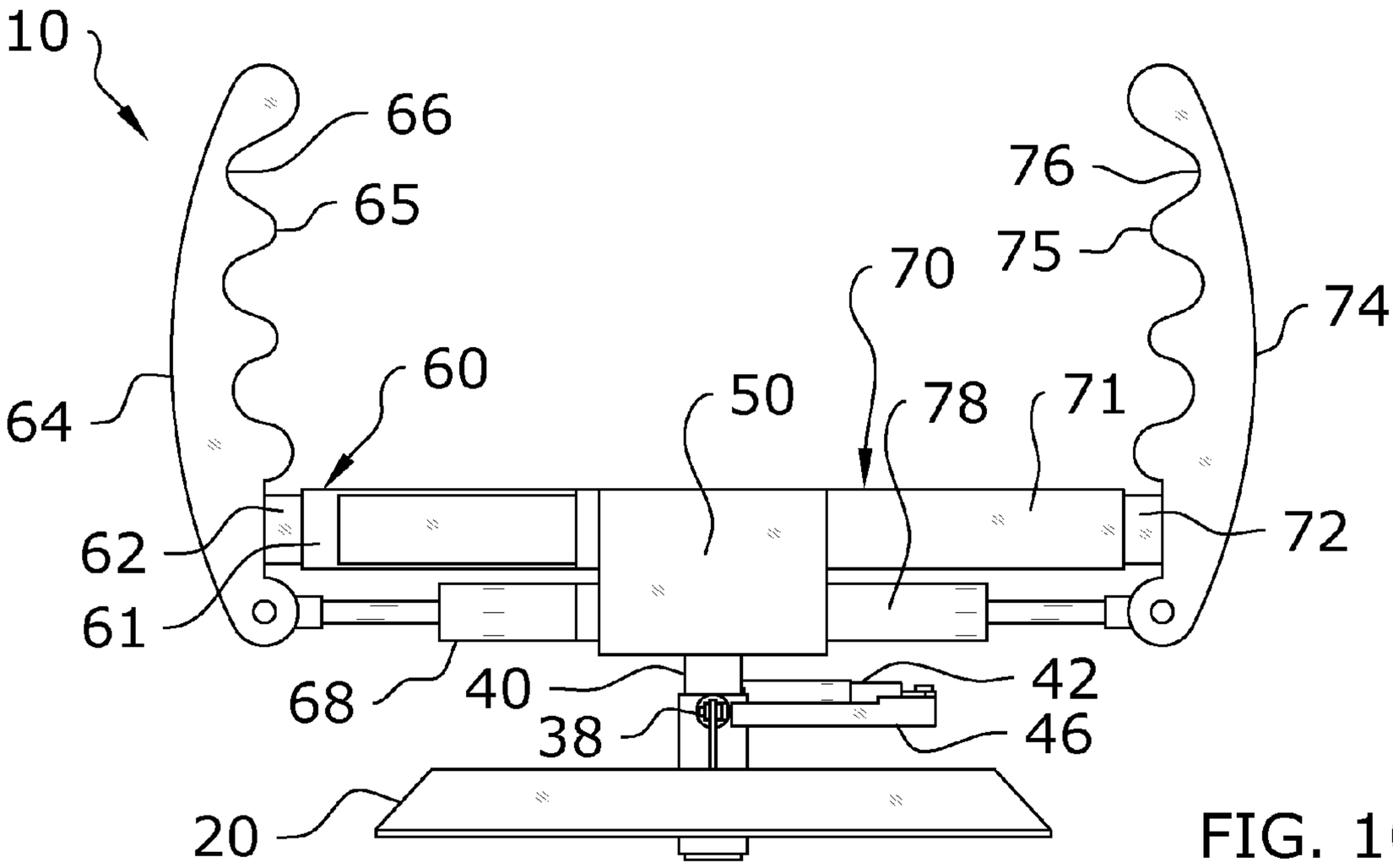
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FIG. 10

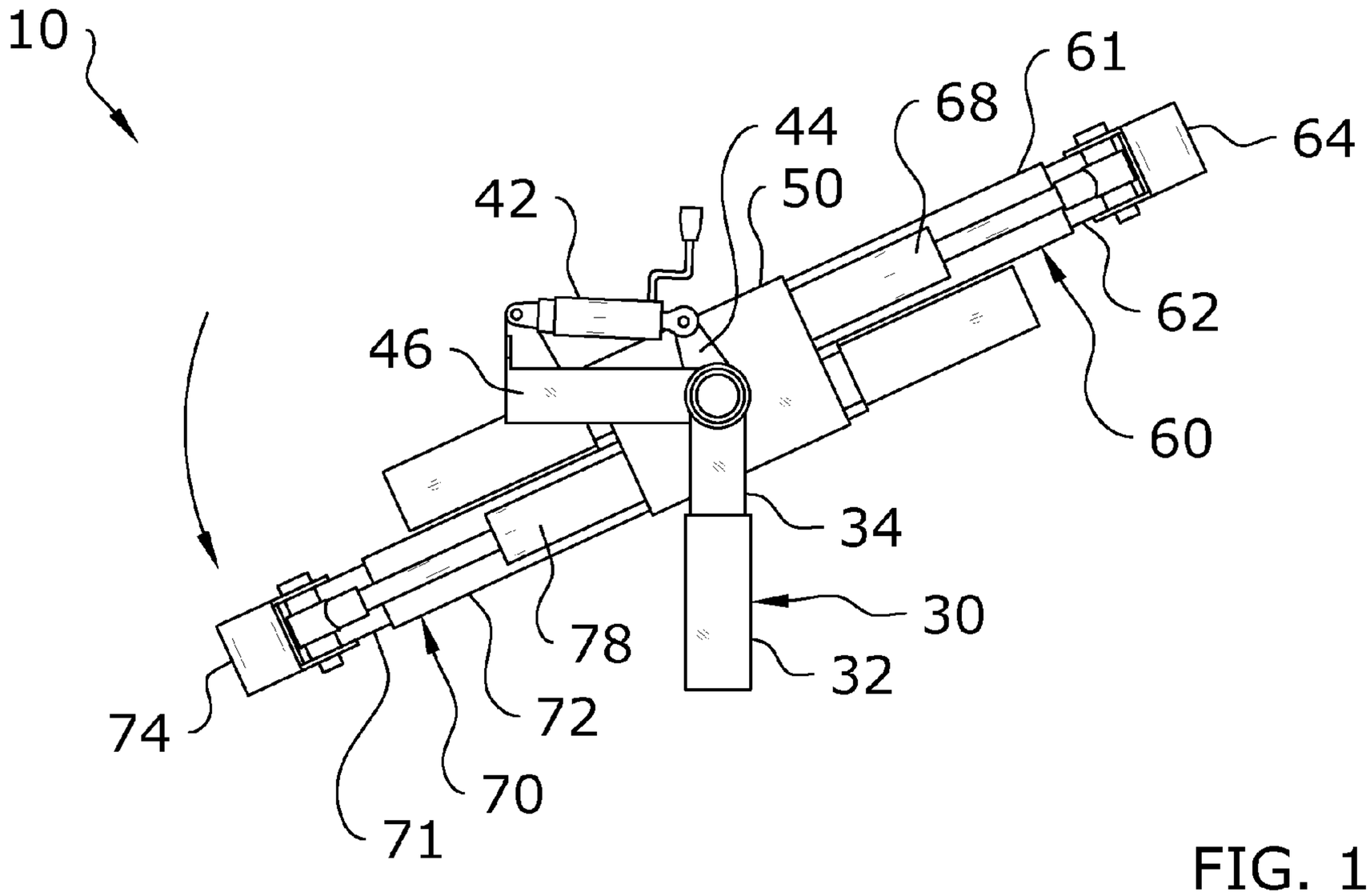
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FIG. 11

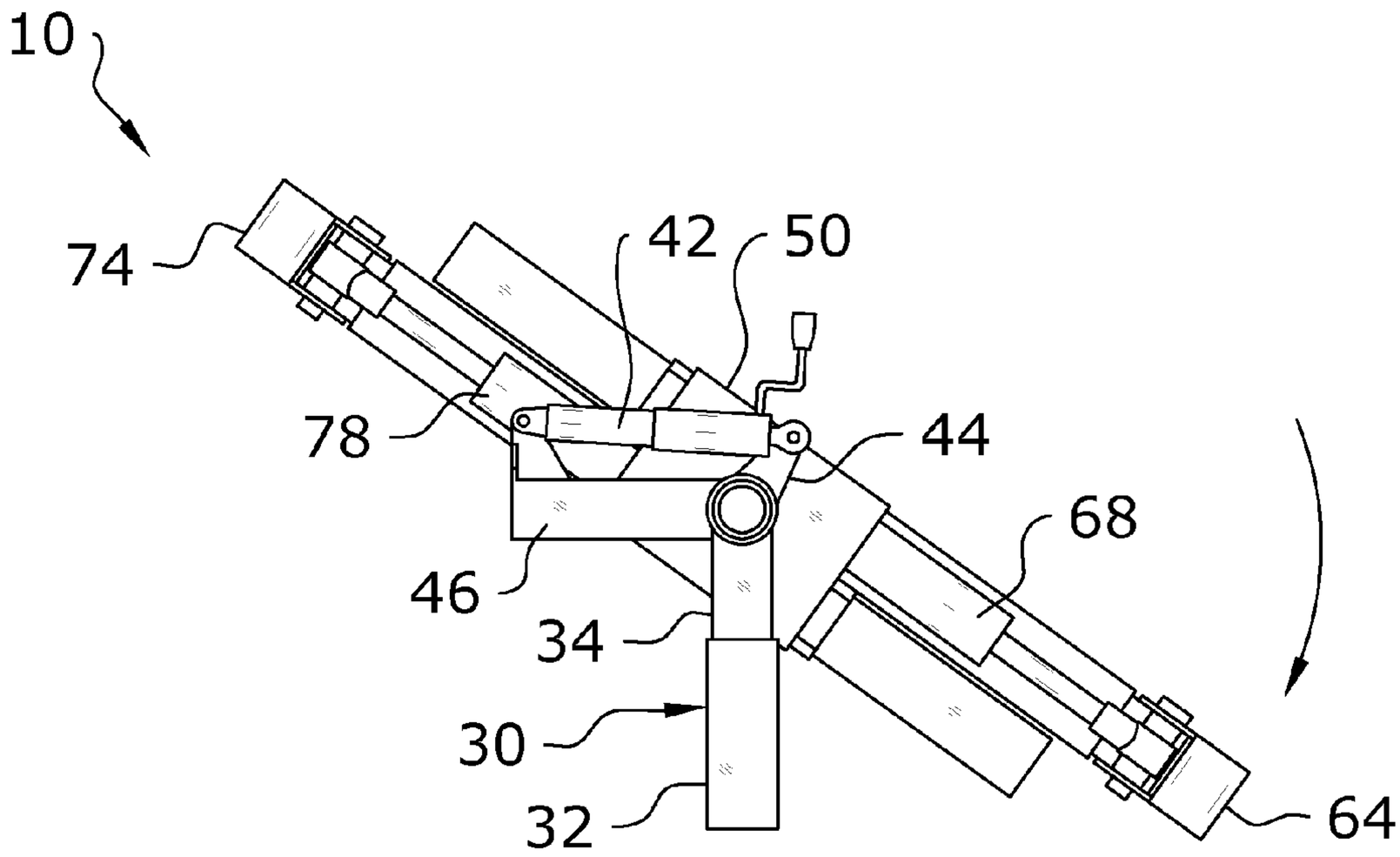
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FIG. 12

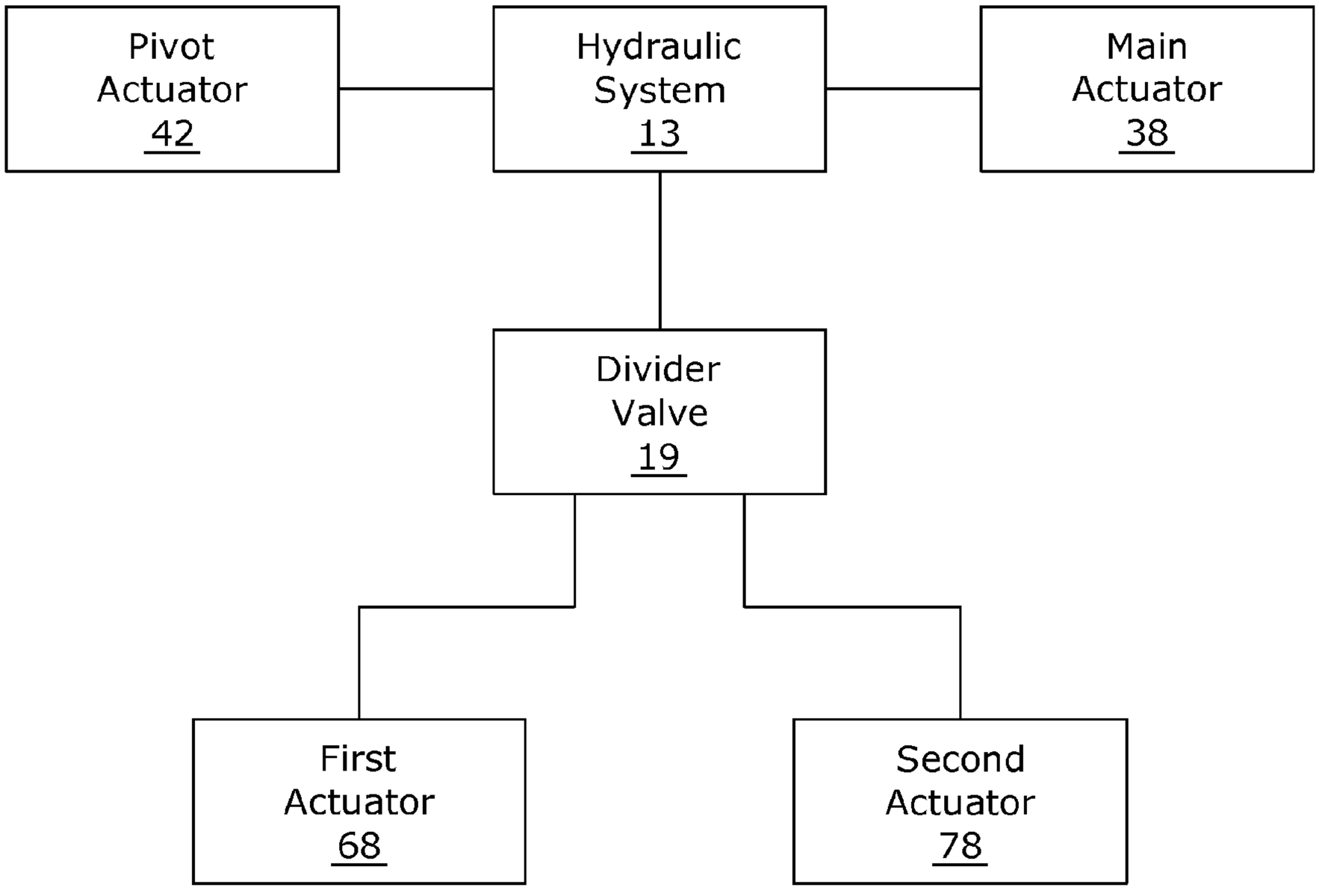
Pivot Actuator 42
Hydraulic System 13
Main Actuator 38
Divider Valve 19
First Actuator 68
Second Actuator 78

FIG. 13

TIRE MANIPULATION SYSTEM

CROSS REFERENCE TO RELATED APPLICATIONS

Not applicable to this application.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not applicable to this application.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to a tire manipulator and more specifically it relates to a tire manipulation system for efficiently manipulating the position of a tire.

2. Description of the Related Art

Any discussion of the related art throughout the specification should in no way be considered as an admission that such related art is widely known or forms part of common general knowledge in the field.

Tires for vehicles can be difficult to remove from a vehicle, move to a different location and install on a vehicle because of their weight and size. For example, two or more workers are typically required to remove, move and install a tire for a tractor which can easily weigh 500 pounds or more. In addition, the tires may have a large diameter of 6 feet or more making it difficult for workers to handle the cumbersome tire. To remove, move, repair and install a large tire, workers will connect a tractor loader or a hoist to the tire with straps/chains thereby allowing them to lift the tire. However, another worker must assist in the connection of the straps/chains and also guide the tire during movement. Because of the significant manual labor involved in manipulating large tires, it is very time consuming and expensive to change/repair a damaged tire on a vehicle.

Because of the inherent problems with the related art, there is a need for a new and improved tire manipulation system for efficiently manipulating the position of a tire.

BRIEF SUMMARY OF THE INVENTION

The invention generally relates to a tire manipulator which includes a mounting device for removable attachment to a tractor, a telescoping main support structure attached to the mounting device, a main actuator connected to the main support structure, a pivot axle rotatably connected to the main support structure, a support frame connected to the pivot axle, and a pair of telescoping supports each having an actuator and a gripping member for engaging a tire to be manipulated. The gripping members first engage the perimeter of a tire to be manipulated and then using the loader system of the tractor, the user is able to manipulate the attitude of the tire.

There has thus been outlined, rather broadly, some of the features of the invention in order that the detailed description thereof may be better understood, and in order that the present contribution to the art may be better appreciated. There are additional features of the invention that will be described hereinafter and that will form the subject matter of the claims appended hereto. In this respect, before explaining at least one embodiment of the invention in detail, it is to be understood that the invention is not limited in its application to the details of construction or to the arrangements of the components set forth in the following description or illustrated in the drawings. The invention is capable of other embodiments and

of being practiced and carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein are for the purpose of the description and should not be regarded as limiting.

BRIEF DESCRIPTION OF THE DRAWINGS

Various other objects, features and attendant advantages of the present invention will become fully appreciated as the same becomes better understood when considered in conjunction with the accompanying drawings, in which like reference characters designate the same or similar parts throughout the several views, and wherein:

FIG. **1***a* is an upper perspective view of the present invention attached to a skid steer tractor with the gripping members extended.

FIG. **1***b* is an upper perspective view of the present invention engaging the tire.

FIG. **1***c* is an upper perspective view of the present invention rotating the tire.

FIG. **1***d* is a side view of the present invention attached to a skid steer tractor and supporting a tire above a floor.

FIG. **1***e* is a side view of the present invention rotated approximately 90 degrees to pick up a tire lying flat on the floor.

FIG. **2** is a rear upper perspective view of the present invention.

FIG. **3** is a front upper perspective view of the present invention.

FIG. **4** is a front upper perspective view with the gripping members extended outwardly.

FIG. **5** is a rear upper perspective view with the gripping members extended outwardly.

FIG. **6** is a rear view of the present invention.

FIG. **7** is a left side view of the present invention.

FIG. **8** is a right side view of the present invention with the gripping members being lifted upwardly by the main actuator.

FIG. **9** is a top view of the present invention.

FIG. **10** is a bottom view of the present invention.

FIG. **11** is a rear view of the present invention with the gripping members rotated counterclockwise.

FIG. **12** is a rear view of the present invention with the gripping members rotated clockwise.

FIG. **13** is a block diagram illustrating the hydraulic fluid connections between the actuators and the hydraulic system of a tractor.

DETAILED DESCRIPTION OF THE INVENTION

A. Overview.

Turning now descriptively to the drawings, in which similar reference characters denote similar elements throughout the several views, FIGS. **1** through **13** illustrate a tire manipulation system **10**, which comprises a mounting device **20** for removable attachment to a tractor **12**, a telescoping main support structure **30** attached to the mounting device **20**, a main actuator **38** connected to the main support structure **30**, a pivot axle **40** rotatably connected to the main support structure **30**, a support frame **50** connected to the pivot axle **40**, and a pair of telescoping supports each having an actuator and a gripping member for engaging a tire **11** to be manipulated. The gripping members **64**, **74** first engage the perimeter of a tire **11** to be manipulated and then using the loader system of the tractor **12** the user is able to manipulate the attitude of the tire **11**.

The present invention may be attached to various types of tractors **12** including, but not limited to, skid steer tractors

(a.k.a. skid-steer loaders), conventional wheeled tractors, conventional tracked tractors and the like. It is preferable that the invention is adapted for attachment to a skid steer tractor **12** which provides increased mobility when handling the tire **11**. U.S. Patent Publication No. 2006/0120848 filed by Troy Guhr illustrates an exemplary skid steer vehicle which is incorporated by reference herein. In addition, the vertical adjustment of the main support structure **30** allows for the loader arms **14** of a skid steer tractor **12** to be lowered sufficiently when supporting a tire **11** to allow the operator of the skid steer tractor **12** to open the front door to work on the tire **11** without the need of a second person outside of the skid steer tractor **12**.

B. Mounting Device.

The mounting device **20** is adapted for removable attachment to a tractor **12**. The mounting device **20** is constructed of a configuration that is capable of being quickly connected and disconnected from the loader arms **14** of a tractor **12**. The mounting device **20** is further preferably comprised of a quick attach mounting plate adapted for connecting to a quick attach connector on the loader arms **14** of a skid steer tractor **12** as illustrated in FIGS. **1***a* through **5** of the drawings. Various other structures and connections may be used for the mounting device **20** to connect the present invention to the loader arms **14** of a tractor **12**. The loader arms **14** of the tractor **12** are used to lift/lower the present invention and to adjust the pitch of the present invention on the pitch axis (i.e. pitch forwardly or pitch rearwardly).

C. Main Support Structure.

The main support structure **30** is attached to the mounting device **20**. The main support structure **30** is preferably adjustable in length to allow for adjustment of the distance of the support frame **50** from the mounting device **20**. The further the support frame **50** is positioned away from the mounting device **20** the lower the height the loader arms **14** on the tractor **12** need to be to support a tire **11** in a desired mounting position on a vehicle thereby allowing the front door of a skid steer tractor **12** to be opened while mounting or dismounting a tire **11**. FIG. **8** illustrates the main support structure **30** extended upwardly to lift the position of the gripping members **64**, **74**.

The main support structure **30** is preferably comprised of a telescopic structure for lowering and raising the pivot axle **40** which pivotally supports the support frame **50**. The main support structure **30** includes a lower support **32** vertically attached to the mounting device **20** and an upper support **34** slidably connected to the lower support **32**. The upper support **34** is extended and retracted with respect to the lower support **32** to adjust the distance the support frame **50** is away from the mounting device **20**. The lower support **32** is stationary with respect to the mounting device **20**. The pivot axle **40** is rotatably connected to the upper end of the upper support **34** opposite of the mounting device **20**. A pivot support **36** is attached to the upper support **34** for rotatably supporting the pivot axle **40** as illustrated in FIGS. **2** and **5** of the drawings.

A main actuator **38** is connected to the main support structure **30** to extend or retract the main support structure **30**. The main actuator **38** is preferably connected between the lower support **32** and the upper support **34** as best illustrated in FIGS. **7** and **8** of the drawings. The main actuator **38** may be comprised of any type of linear actuator such as, but not limited to, mechanical actuators, hydraulic actuators, electro-mechanical actuators and the like.

D. Pivot Structure.

The pivot axle **40** is rotatably connected to the upper end of the main support structure **30** as discussed previously and as shown in FIGS. **2** and **5** of the drawings. The pivot axle **40** rotatably supports the support frame **50** relative to the main support structure **30**. The pivot axle **40** may be comprised of any central shaft structure that is rotatably positioned within the pivot support **36**. The pivot support **36** is preferably a tubular structure with the pivot axle **40** rotatably extending through the pivot support **36**. The pivot axle **40** allows for sufficient rotation of the support frame **50** such that the tire **11** may be rotated clockwise or counterclockwise as illustrated in FIGS. **11** and **12** of the drawings. The pivot axle **40** preferably has a pivot axis that is substantially perpendicular to the mounting device **20** and perpendicular to the forward motion of the tractor **12**.

A pivot actuator **42** is connected to the pivot axle **40**, wherein the pivot actuator **42** rotates the pivot axle **40** with respect to the main support structure **30** and the pivot support **36**. A pivot frame **46** extends from the main support structure **30** and a pivot arm **44** is connected to the pivot axle **40** as best illustrated in FIGS. **11** and **12** of the drawings. The pivot actuator **42** is connected between the pivot frame **46** and the pivot arm **44** as further shown in FIGS. **11** and **12**. The pivot actuator **42** may be comprised of any type of linear actuator such as, but not limited to, mechanical actuators, hydraulic actuators, electro-mechanical actuators and the like. The pivot actuator **42** may also be comprised of a non-linear actuator such as a conventional electric motor or hydraulic motor. The pivot structure may alternatively not include an actuator and instead the user simply manually manipulates the rotational position of the support frame **50**.

E. Support Frame.

The support frame **50** is connected to the pivot axle **40** and is rotatably supported by the pivot axle **40** with respect to the main support structure **30** to allow for rotation of the support frame **50** as illustrated in FIGS. **11** and **12** of the drawings. The support frame **50** may be comprised of various structure capable of supporting the telescoping supports such as a U-shaped bracket or box-type structure.

F. Telescoping Supports.

The first telescoping support **60** is attached to the support frame **50** extending in a first direction as illustrated in FIGS. **2**, **3**, **4**, **5**, **9**, **10** of the drawings. The first telescoping support **60** is comprised of a structure capable of extending outwardly and retracting inwardly to move a corresponding first gripping member **64** to selectively release and secure a tire **11**. The first telescoping support **60** is preferably comprised of a telescopic structure having at least a first inner portion **61** attached to the support frame **50** and a first outer portion **62** slidably connected to the first inner portion **61** as further illustrated in FIGS. **2**, **3**, **4**, **5**, **9**, **10** of the drawings. The first gripping member **64** is attached to the distal end of the first outer portion **62** of the first telescoping support **60** and extends substantially transversely with respect to the first telescoping support **60** as best illustrated in FIGS. **9** and **10** of the drawings.

A first actuator **68** is connected to the first outer portion **62** and is adapted to extend or retract the first outer portion **62** with respect to the first inner portion **61**. The first actuator **68** is connected to the support frame **50** or the first inner portion **61** opposite of the first outer portion **62**. The first actuator **68** is preferably substantially parallel with respect to the first telescoping support **60**. The first actuator **68** may be comprised of any type of linear actuator such as, but not limited to, mechanical actuators, hydraulic actuators, electro-mechanical actuators and the like.

The second telescoping support **70** is attached to the support frame **50** extending in a second direction which is opposite of the first direction for the first telescoping support **60** as illustrated in FIGS. **2**, **3**, **4**, **5**, **9**, **10** of the drawings. The first

telescoping support **60** is preferably substantially parallel with respect to the second telescoping support **70**.

The second telescoping support **70** is comprised of a structure capable of extending outwardly and retracting inwardly to move a corresponding second gripping member **74** to selectively release and secure a tire **11**. The second telescoping support **70** is preferably comprised of a telescopic structure having at least a second inner portion **71** attached to the support frame **50** and a second outer portion **72** slidably connected to the second inner portion **71** as further illustrated in FIGS. **2**, **3**, **4**, **5**, **9**, **10** of the drawings. The second gripping member **74** is attached to the distal end of the second outer portion **72** of the second telescoping support **70** and extends substantially transversely with respect to the second telescoping support **70** as best illustrated in FIGS. **9** and **10** of the drawings.

A second actuator **78** is connected to the second outer portion **72** and is adapted to extend or retract the second outer portion **72** with respect to the second inner portion **71**. The second actuator **78** is connected to the support frame **50** or the second inner portion **71** opposite of the second outer portion **72**. The second actuator **78** is preferably substantially parallel with respect to the second telescoping support **70**. The second actuator **78** may be comprised of any type of linear actuator such as, but not limited to, mechanical actuators, hydraulic actuators, electro-mechanical actuators and the like. It is preferable to use a divider valve fluidly connected to the hydraulic system **13** of the tractor **12** to evenly control the flow of pressurized hydraulic fluid to the first actuator **68** and the second actuator **78** to achieve the same distance of extension and retraction of the telescopic supports **60**, **70**. The pivot actuator **42** and the main actuator **38** are further preferably connected to the hydraulic system **13** of the tractor **12** as illustrated in FIG. **13** of the drawings.

G. Gripping Members.

A first gripping member **64** is attached to the first telescoping support **60** and a second gripping member **74** is attached to the second telescoping support **70** opposite of the first gripping member **64**. The first gripping member **64** and the second gripping member **74** preferably mirror one another and are in opposition to one another to grip a tire **11** between the gripping members **64**, **74**. The gripping members **64**, **74** form a substantially U-shaped structure with the telescoping supports **60**, **70** that selectively contracts and expands as best illustrated in FIGS. **9** and **10** of the drawings.

The first gripping member **64** is adapted to engage a first side of a tire **11** and the second gripping member **74** is adapted to engage a second side of the tire **11** opposite of the first side of the tire **11** as illustrated in FIGS. **1***a* through **1***e* of the drawings. The first gripping member **64** and the second gripping member **74** extend forwardly and away from the mounting device **20** and the support frame **50** to selectively engage a tire **11**. The first gripping member **64** and the second gripping member **74** are substantially parallel with respect to one another to provide secure gripping of the opposing sides of the tire **11**. The first gripping member **64** and the second gripping member **74** are both preferably substantially transverse with respect to the first telescoping support **60** and the second telescoping support **70** as further shown in FIGS. **9** and **10** of the drawings. The gripping members **64**, **74** do not have to be on the same plane as they can be offset slightly as illustrated in FIG. **6** of the drawings.

The gripping members **64**, **74** each include an inner portion that faces the opposite inner portion. The inner portion may have a straight structure or a slightly inwardly curved structure. The first gripping member **64** and the second gripping member **74** each preferably include a plurality of jaws **65**, **75** that extend inwardly. The first gripping member **64** and the second gripping member **74** each preferably include a plurality of recessed portions **66**, **76** between the plurality of jaws **65**, **75**. The plurality of jaws **65**, **75** are preferably constructed of a convex rounded structure to avoid damage to the tire **11** being manipulated. The plurality of recessed portions **66**, **76** are preferably constructed of a concave configuration as shown in FIGS. **9** and **10** of the drawings. As illustrated in FIGS. **2**, **3**, **4**, **5**, **7** and **8** of the drawings, it is preferable that the gripping members **64**, **74** each include two vertically spaced apart rows of jaws **65**, **75** and recessed portions **66**, **76**.

H. Operation of Preferred Embodiment.

In use, the user connects the invention to a tractor **12** such as a skid steer loader by connecting the loader arms **14** to the mounting device **20**. The user then adjusts the pitch of the invention utilizing the loader arms **14** and connecting structure on the loader arms **14** using the hydraulic system **13** of the tractor **12**.

If the user needs to pick up a tire **11** that is lying flat on the floor **18** as illustrated in FIG. **1***e* of the drawings, the user adjusts the pitch of the invention forwardly, extends the gripping members **64**, **74** outwardly outside of the tire **11**, positions the gripping members **64**, **74** centrally above the tire **11** and then lowers the loader arms **14** to lower the gripping members **64**, **74** about the outside of the tire **11**. The user then activates the first actuator **68** and the second actuator **78** to contract the gripping members **64**, **74** towards one another until the gripping members **64**, **74** have fully gripped the tire **11**. The user then is able to lift the tire **11** by elevating the loader arms **14** and then the user is able to transport the tire **11** to a desired location. If the user desires to mount the tire **11** on a vehicle, the user then pitches the invention rearwardly until the tire **11** is substantially vertically orientated as illustrated in FIG. **1***b* of the drawings. The user then drives the tractor **12** to position the tire **11** near the hub. The user activates the pivot actuator **42** to adjust the rotational position of the tire **11** with respect to the hub to align the mounting fasteners of the hub with the holes in the rim of the tire **11** as illustrated in FIG. **1***c* of the drawings. Once the holes of the rim of the tire **11** are properly aligned, the user moves the tire **11** forwardly until the threaded mounting fasteners are fully extended through the holes in the rim. The user is then able to secure the lug nuts to the mounting fasteners and then release the gripping members **64**, **74** from the tire **11**. A similar process may be used to remove a tire **11** from a vehicle as illustrated in FIG. **1***a* of the drawings.

Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. Although methods and materials similar to or equivalent to those described herein can be used in the practice or testing of the present invention, suitable methods and materials are described above. All publications, patent applications, patents, and other references mentioned herein are incorporated by reference in their entirety to the extent allowed by applicable law and regulations. The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and it is therefore desired that the present embodiment be considered in all respects as illustrative and not restrictive. Any headings utilized within the description are for convenience only and have no legal or limiting effect.

The invention claimed is:

1. A tire manipulation system, comprising:

a mounting device adapted for removable attachment to a tractor;

a main support structure attached to said mounting device;

a pivot axle rotatably connected to said main support structure;

wherein said main support structure is comprised of a telescopic structure for lowering and raising said pivot axle;

a support frame connected to said pivot axle, wherein said support frame is rotatably supported by said pivot axle with respect to said main support structure;

a first telescoping support attached to said support frame extending in a first direction;

a first gripping member attached to said first telescoping support, wherein said first gripping member is adapted to engage a first side of a tire;

a second telescoping support attached to said support frame extending in a second direction; and

a second gripping member attached to said second telescoping support, wherein said second gripping member is adapted to engage a second side of the tire opposite of the first side of the tire.

2. The tire manipulation system of claim **1**, including a main actuator connected to said main support structure to extend or retract said main support structure.

3. The tire manipulation system of claim **1**, wherein said main support structure is comprised of a lower support attached to said mounting device and an upper support slidably connected to said lower support, wherein said pivot axle is connected to said upper support.

4. The tire manipulation system of claim **1**, wherein said pivot axle has a pivot axis that is substantially perpendicular to said mounting device.

5. The tire manipulation system of claim **1**, wherein said first direction is opposite of said second direction.

6. The tire manipulation system of claim **1**, wherein said first gripping member and said second gripping member extend away from said mounting device.

7. The tire manipulation system of claim **6**, wherein said first gripping member and said second gripping member are substantially parallel with respect to one another.

8. The tire manipulation system of claim **7**, wherein said first gripping member and said second gripping member are both substantially transverse with respect to said first telescoping support and said second telescoping support.

9. The tire manipulation system of claim **8**, wherein said first telescoping support is substantially parallel with respect to said second telescoping support.

10. The tire manipulation system of claim **1**, wherein said first gripping member and said second gripping member each include a plurality of jaws that extend inwardly.

11. The tire manipulation system of claim **10**, wherein said first gripping member and said second gripping member each include a plurality of recessed portions between said plurality of jaws.

12. The tire manipulation system of claim **11**, wherein said plurality of jaws are comprised of a rounded structure.

13. The tire manipulation system of claim **1**, including a pivot actuator connected to said pivot axle, wherein said pivot actuator rotates said pivot axle with respect to said main support structure.

14. The tire manipulation system of claim **13**, including a pivot frame extending from said main support structure and a pivot arm connected to said pivot axle, wherein said pivot actuator is connected between said pivot frame and said pivot arm.

15. The tire manipulation system of claim **1**, wherein said mounting device is comprised of a quick attach mounting plate for a skid steer tractor.

16. The tire manipulation system of claim **1**, wherein said first telescoping support is comprised of a first inner portion attached to said support frame, a first outer portion slidably connected to said first inner portion, wherein said first gripping member is attached to said first outer portion, and a first actuator connected to said first outer portion, wherein said first actuator is adapted to extend or retract said first outer portion with respect to said first inner portion.

17. The tire manipulation system of claim **16**, wherein said second telescoping support is comprised of a second inner portion attached to said support frame, a second outer portion slidably connected to said second inner portion, wherein said second gripping member is attached to said second outer portion, and a second actuator connected to said second outer portion, wherein said second actuator is adapted to extend or retract said second outer portion with respect to said second inner portion.

18. A tire manipulation system, comprising:

a mounting device adapted for removable attachment to a tractor;

a main support structure attached to said mounting device;

a pivot axle rotatably connected to said main support structure;

a support frame connected to said pivot axle, wherein said support frame is rotatably supported by said pivot axle with respect to said main support structure;

a first telescoping support attached to said support frame extending in a first direction;

a first gripping member attached to said first telescoping support, wherein said first gripping member is adapted to engage a first side of a tire;

a second telescoping support attached to said support frame extending in a second direction;

a second gripping member attached to said second telescoping support, wherein said second gripping member is adapted to engage a second side of the tire opposite of the first side of the tire;

a pivot actuator connected to said pivot axle, wherein said pivot actuator rotates said pivot axle with respect to said main support structure; and

a pivot frame extending from said main support structure and a pivot arm connected to said pivot axle, wherein said pivot actuator is connected between said pivot frame and said pivot arm.

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